Application No.: 10/694,310
Reply to Office Action of April 14, 2005

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) A method for ~~simultaneously~~ regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, comprising:

providing a first oxygen sensor upstream of the particulate filter;

providing a second oxygen sensor at a position downstream of the particulate filter and upstream of the trap; ~~producing regeneration in the particulate filter, such regeneration producing an exhaust gas exiting the particulate trap having an elevated temperature and reduced oxygen concentration relative to gases entering such particulate filter~~ and

controlling the particulate filter regeneration rate and NOx trap desufation in response to both the metered oxygen flow of gases entering the particulate filter using the first oxygen sensor and oxygen content of gases entering the lean NOx trap using the second oxygen sensor.

~~, such exiting gases producing desulfation in the lean NOx trap.~~

2. (previously presented) The method recited in claim 1 including adjusting at least one engine operating parameter to control both regeneration in the particulate filter and the desulfation of the lean NOx trap.

3. (currently amended) . A method for ~~simultaneously~~ regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, comprising:

providing a first oxygen sensor upstream of the particulate filter;

providing a second oxygen sensor at a position downstream of the particulate filter and upstream of the trap; and

adjusting, in response to the first and second oxygen sensors, at least one engine operating parameter to maintain a desired air fuel ratio for gases exiting the ~~lean NOx trap~~ particulate filter in accordance with a difference between a reference set point air fuel ratio level and the air fuel ratio of gases exiting the ~~lean NOx trap~~ particulate filter and wherein the reference set point level is changed between a rich air fuel ratio and a lean air fuel ratio as a function of the air fuel ratio of the gases exiting the lean NOx trap.

4. (currently amended) ~~The method recited in claim 3~~ A method for simultaneously regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, comprising:

adjusting at least one engine operating parameter to maintain a desired air fuel ratio for gases exiting the particulate filter in accordance with a difference between a reference set point air fuel ratio level and the air fuel ratio of gases exiting the particulate filter and wherein the reference set point level is changed between a rich air fuel ratio and a lean air fuel ratio as a function of the air fuel ratio of the gas exiting the lean NOx trap wherein the regeneration control comprises:

commencing a self-sustaining filter regeneration;

monitoring whether said regeneration causes temperature of said particulate filter to become greater than a predetermined value;

in response to said monitoring, adjusting one or more operating parameters so as to limit exothermic reaction via control of an excess oxygen amount entering said filter and prevent temperature from rising to become greater than a pre-selected value..

5. (original) A method for ~~simultaneously~~ regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, comprising:

providing a first oxygen sensor upstream of the particulate filter;

providing a second oxygen sensor at a position downstream of the particulate filter and upstream of the trap;

controlling, in response to the first and second oxygen sensors, the oxygen concentration of the gas exiting the ~~LNT~~ lean NOx trap by commanding an oxygen concentration setpoint for the gas entering the ~~LNT~~ lean NOx trap, such commanded oxygen concentration being controlled by commanding an oxygen concentration setpoint for the gas entering the particulate filter.

6. (currently amended) A method for ~~simultaneously~~ regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, comprising:

providing ~~an~~ a first oxygen sensor upstream of the particulate filter and using a signal produced by such sensor to control the particulate filter regeneration rate by metering the oxygen flow sensed by sensor and;

providing ~~an~~ a second oxygen sensor at a position downstream of the particulate filter and upstream of the lean NOx trap and using a signal produced by such second sensor to control the oxygen content of the gas entering the lean NOx trap.

7. (currently amended) A method for simultaneously regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, comprising:

providing a first oxygen sensor upstream of the particulate filter;

providing a second oxygen sensor at a position downstream of the particulate filter and upstream of the trap; and

adjusting, in response to the first and second sensors, the oxygen level into the particulate filter, comprising:

reducing the oxygen content of the gas entering the particulate filter if the oxygen concentration measured by downstream oxygen sensor is greater than a predetermined level, such latter oxygen content being measured by the upstream

oxygen sensor;

increasing the oxygen content of the gas entering the particulate filter if the oxygen concentration measured by downstream oxygen sensor is less than the predetermined level, such latter oxygen content being measured by the upstream oxygen sensor.

8. (original) The method recited in claim 7 including:

monitoring the temperature of the gas exiting the particulate filter and reducing the oxygen concentration into the particulate filter if such measured temperature becomes greater than a predetermined level.

9. (original) The method from claim 7 including:

monitoring the temperature of the gas exiting the lean NOx trap and increasing the oxygen concentration into the particulate filter if such measured temperature becomes greater than a predetermined level.

10. (currently amended) A system , comprising:

a particulate filter coupled to an internal combustion engine;

a lean NOx trap disposed downstream of the particulate filter; and

a first oxygen sensor disposed upstream of the filter;

a second oxygen sensor positioned downstream of the particulate filter and downstream of the lean NOx trap; and

a processor for simultaneously controlling the particulate filter regeneration rate and NOx trap desufation in response to the both the metered oxygen flow of gases entering the particulate filter using the first oxygen sensor and oxygen content of gases entering the lean NOx trap using the second oxygen sensor.

~~for producing regeneration in the particulate filter, such regeneration producing an exhaust gas exiting the particulate trap having an elevated temperature and reduced oxygen concentration relative to gases entering such particulate filter, such exiting gases producing~~

~~desulfation in the lean NOx trap to simultaneously produce regeneration in the particulate filter and to produce for desulfating in the lean NOx trap, such regeneration producing an exhaust gas exiting the particulate trap having an elevated temperature and reduced oxygen concentration relative to gases entering such particulate filter, such exiting gases producing such desulfation in the lean NOx trap.~~

11. (currently amended) The system recited in claim ~~11~~ 10 wherein the processor including adjusts at least one engine operating parameter to control both regeneration in the particulate filter and the desulfation of the lean NOx trap.

12. (currently amended) A system, comprising:

a particulate filter coupled to an internal combustion engine;

a lean NOx trap disposed downstream of the particulate filter; and

a first oxygen sensor disposed upstream of the filter;

a second oxygen sensor positioned downstream of the particulate filter and downstream of the lean NOx trap; and

a processor, responsive to the first and second oxygen sensors, for simultaneously producing regeneration in the particulate filter and producing desulfating in the lean NOx trap by adjusting at least one engine operating parameter to maintain a desired air fuel ratio for gases exiting the ~~lean NOx trap~~ particulate filter in accordance with a difference between a reference set point air fuel ratio level and the air fuel ratio of gases exiting the ~~lean NOx trap~~ particulate filter to simultaneously produce regeneration in the particulate filter and to produce for desulfating in the lean NOx trap, and wherein the reference set point level is changed between a rich air fuel ratio and a lean air fuel ratio as a function of the air fuel ratio of the exiting gas the lean NOx trap.

13. (currently amended) ~~The system recited in claim 12~~ A system, comprising:

a particulate filter coupled to an internal combustion engine;

a lean NOx trap disposed downstream of the particulate filter; and

a processor for simultaneously producing regeneration in the particulate filter and producing desulfating in the lean NOx trap by adjusting at least one engine operating parameter to maintain a desired air fuel ratio for gases exiting the particulate filter in accordance with a difference between a reference set point air fuel ratio level and the air fuel ratio of gases exiting the particulate filter to simultaneously produce regeneration in the particulate filter and to produce for desulfating in the lean NOx trap, and wherein the reference set point level is changed between a rich air fuel ratio and a lean air fuel ratio as a function of the air fuel ratio of the gas exiting the lean NOx trap;

wherein the regeneration control comprises:

commencing a self-sustaining filter regeneration;

monitoring whether said regeneration causes temperature of said particulate filter to become greater than a predetermined value;

in response to said monitoring, adjusting one or more operating parameters so as to limit exothermic reaction via control of an excess oxygen amount entering said filter and prevent temperature from rising to become greater than a pre-selected value..

14. (currently amended) A system, comprising:

a particulate filter coupled to an internal combustion engine;

a lean NOx trap disposed downstream of the particulate filter; and

a first oxygen sensor disposed upstream of the filter;

a second oxygen sensor positioned downstream of the particulate filter and downstream of the lean NOx trap; and

a processor, responsive to the first and second oxygen sensors, for producing signals to simultaneously regenerate the particulate filter and to desulfate the lean NOx trap by controlling the oxygen concentration of the gas exiting the ~~lean NOx trap~~ particulate filter by commanding an oxygen concentration setpoint for the gas entering the ~~lean NOx trap~~ particulate filter, such commanded oxygen concentration being controlled by commanding an oxygen concentration setpoint for the gas entering the particulate filter.

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15. (currently amended) A system, comprising:

a particulate filter coupled to an internal combustion engine;

a lean NOx trap disposed downstream of the particulate filter; and

a processor for simultaneously regenerating the particulate filter and for desulfating the lean NOx trap, comprising:

providing ~~an~~ a first oxygen sensor upstream of the particulate filter and using a signal produced by such sensor to control the particulate filter regeneration rate by metering the oxygen flow sensed by sensor and;

providing ~~an~~ a second oxygen sensor positioned downstream of the particulate filter and upstream of the lean NOx trap and using a signal produced by such second sensor to control the oxygen content of the gas entering the lean NOx trap.

16. (currently amended) A system, comprising:

a particulate filter coupled to an internal combustion engine;

a lean NOx trap disposed downstream of the particulate filter; and

a first oxygen sensor disposed upstream of the filter;

a second oxygen sensor positioned downstream of the particulate filter and downstream of the lean NOx trap; and

a processor, responsive to the first and second sensors, for simultaneously regenerating the particulate and for desulfating the lean NOx trap, comprising:

adjusting the oxygen level into the particulate filter, comprising:

reducing the oxygen content of the gas entering the particulate filter if the oxygen concentration measured by downstream oxygen sensor is greater than a predetermined level, such latter oxygen content being measured by the upstream oxygen sensor;

increasing the oxygen content of the gas entering the particulate filter if the oxygen concentration measured by downstream oxygen sensor is less than the predetermined level, such latter oxygen content being measured by the upstream oxygen sensor.

17. (original) The system recited in claim 16 wherein the processor:

monitors the temperature of the gas exiting the particulate filter and reducing the oxygen concentration into the particulate filter if such measured temperature becomes greater than a predetermined level.

18. (original) The system recited in claim 17 wherein the processor monitors the temperature of the gas exiting the lean NOx trap and increasing the oxygen concentration into the particulate filter if such measured temperature becomes greater than a predetermined level.

19. (currently amended) An article of manufacture comprising:

a computer storage medium having a program encoded for simultaneously regenerating a particulate filter coupled to an internal combustion engine and for desulfating a lean NOx trap disposed downstream of the particulate filter, such computer storage medium comprising:

code for adjusting at least one engine operating parameter in response to a first oxygen sensor upstream of the particulate filter and a second oxygen sensor positioned downstream of the particulate filter and upstream of the trap to maintain a desired air fuel ratio for gases exiting the ~~lean NOx trap~~ particulate filter in accordance with a difference between a reference set point air fuel ratio level and the air fuel ratio of gases exiting the ~~lean NOx trap~~ particulate filter and wherein the reference set point level is changed between a rich air fuel ratio and a lean air fuel ratio as a function of the air fuel ratio of the gas exiting the lean NOx trap.

20. (original) The article of manufacture recited in claim 19 wherein the computer storage medium is a semiconductor chip.